

Sub B1
100 parts by weight of the polyol component; and
a phosphorous antioxidant in an amount of 0.5-6.0 parts by weight for 100 parts
by weight of the polyol component[,
wherein the polyurethane raw material is substantially free of dibutyl cresol].

Sub B2
2. (ONCE AMENDED) The polyurethane foam according to claim 1, wherein the polyurethane raw material further comprises, in relation to 100 parts by weight of the polyol component, an isocyanate component (10-80 parts by weight), a catalyst (0.01-2.0 parts by weight), a foaming agent (1.0-25.0 parts by weight), and a foam stabilizer 0.1-3.0 parts by weight).

Sub B2
5. (ONCE AMENDED) The polyurethane foam according to claim 1, wherein the phenolic antioxidant is selected to be only 3,9-bis[1,1-dimehtyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane.

Attached hereto is a "Version with Markings to Show Changes Made", comprising a marked-up version of the claims. 37 C.F.R. §1.121 (c)(I)(ii).

C. In the Abstract

Please replace the current Abstract with the following Abstract.

3
A soft polyurethane foam obtained by foaming a polyurethane raw material including a phenolic antioxidant selected from 3,9-bis[1,1-dimehtyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane and/or 2,2'-thio-diethylene bis [3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate in an amount of 0.05 - 2.0 parts by weight, a benzotriazole type UV absorbing agent in an amount of 0.1 - 3.0 parts by weight, and a phosphorus type antioxidant in an amount of 0.5 - 6.0 parts by weight for 100 parts by weight of a polyol component. Color migration and discoloration of a soft polyurethane foam are prevented.

II. REMARKS

A. Introduction

In this non-final Office Action, claims 1-6 are noted as pending and are rejected based on prior art.

In summary of this Response, claims 1, 2 and 5 are amended, and remarks are provided.

B. Objections to the Specification/Rejection of Claims Under 35 U.S.C. § 112

In regard to numbered paragraphs 1-4 of the Office Action, the Examiner's questions/requirements are addressed below.

Numbered paragraphs 1, 2, 4(partial): Table 1 on page 8 is amended to indicate that the polyol component of Example 7 is 100%, as with the remaining examples, and as with Example 7 in the parent application. Also, each instance in the written description, abstract and claims wherein "3, 9-bis[2-{3-(3-t-butyl-4-hydroxy-5-methylphenyl) propionyloxy}-1,1-dimethylethyl]-2,4,8,10-tetraoxapiro [5,5] undecane" appears has been replaced with "3,9-bis[1,1-dimethyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxyethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane", as noted by the Examiner. Claim 1 is also amended to indicate the phenolic antioxidants in the alternative.

Numbered paragraph 3: Claim 2 is amended to correspond to the disclosure at page 5, line 4 of the application as filed.

Numbered paragraph 4: The Examiner indicates that it is unclear what "substantially free" of dibutyl cresol means. Page 1, paragraph [0004] of the present application, states that the source of dibutyl cresol is in relation to the conventional polyol raw material. See also the Duffy et al. (USP 5,382,602) at Col. 2, lines 61-68 and Col. 3, lines 1-7. Independent claim 1 has been amended to recite "a dibutyl cresol-free polyol". See, e.g., page 2, numbered paragraph [0009], line 3, and Table 1, compare Examples 1-7 where no BHT (antioxidant "4") is used, but YI values are superior to the Comparative Examples 1-6, wherein BHT is added to the polyol.

C. Prior Art Rejection

Claims 1-6 are rejected as being made obvious by a combination of St. Clair et al., which is cited for disclosing each recited feature except the specific recited phenolic antioxidants, and Ishii et al., which is cited for teaching the use of 3,9-bis[1,1-dimethyl-2-[3-(3-tert-butyl-4-hydroxy-5 methylphenyl)propionyloxy]ethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane, or Duffy et al., which is cited for teaching the use of 2-2'-thio-diethylene bis [3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate, as antioxidants for use with polyurethanes.

For the following reasons, it is respectfully submitted that the present invention, as recited by amended claims 1-6, was not rendered obvious by the cited combination.

Initially, as pointed out by the Examiner, St. Clair et al. teaches the use of relatively high molecular weight polydiene diols, i.e., 1000 to 10,000. Col. 2, line 60. In contrast, the present invention, as recited by independent claim 1, relates to only two phenolic antioxidant compounds, with inherent molecular weights of 741 and 642.9, respectively. See page 3, numbered paragraph [0015] of the application as filed. Thus, the issue is whether the prior art suggests substituting St. Clair et al.'s high molecular weight polydiene diols with the two specific lower molecular weight compounds recited. It is respectfully submitted that the answer is no.

Ishii et al., does appear to relate to improving the color of polyurethane compositions, but does not appear to teach the use of "3,9-bis[1,1-dimehtyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane" as a antioxidant component to be added to the polyol. Instead, it appears to refer to this compound as a precursor for making the compound (I) shown in Col. 1, lines 56-65, to which a light stabilizer and an amine stabilizer are added. More particularly, it is stated that "The phenolic type compound . . . (I) . . . can be produced by esterification of 3-(3-alkyl-5-tert-butyl-4-hydroxyphenyl)propionic acid or its acid halide or acid anhydride with 3,9-bis[1,1-dimehtyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]-2,4,8,10 tetraoxaspiro[5.5]undecane...". Col. 2, lines 3-8. In the present invention, the anti-oxidant 3,9-bis[1,1-dimehtyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane is added directly to the polyol.

One of ordinary skill would not consider, upon review of Ishii et al., adding 3,9-bis[1,1-dimehtyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane directly to the polydiene diol of St. Clair et al.. What would be the motivation for adding this compound directly, instead of merely considering it to be a precursor to another component?

Even if one of ordinary skill were to consider adding it directly, what type of effect might be expected in the St. Clair et al. polyurethane? For example, by adding the relatively low molecular weight (i.e., 741) compound of Ishii et al. in place of the higher molecular weight (1000-10,000) compound of St. Clair et al., what kind of discoloration, color migration or other properties might be expected by one of ordinary skill in the art? This level of uncertainty does not equate to obviousness.

As for Duffy et al., there is no mention therein of the present invention's goal of reducing discoloration or color migration that is caused by dibutyl cresol. Instead, this reference discusses the fact that dibutyl cresol (BHT) is conventionally used as a free-radical inhibitor to

stabilize polyether polyols, but the dibutyl cresol causes visible smoke during a rapid cool process. Instead of using dibutyl cresol, Duffy et al. suggests other non-volatile inhibitors, such as IRGANOX 1035 (2-2'-thio-diethylene bis [3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate]).

Again, when one of ordinary skill is seeking to improve upon the color fastness of known polyurethane foams made of dibutyl cresol based polyols, Duffy et al. fails to suggest a motivation for replacing the dibutyl cresol with 2-2'-thio-diethylene bis [3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate. Most particularly, there is no indication as to what would happen to color fastness if this compound were added to the polyol. Also, by adding the relatively low molecular weight compound of Duffy et al. (642.9) in place of the higher molecular weight (1000-10,000) compound of as St. Clair et al., what kind of polyurethane color or other properties might have been expected by one of ordinary skill in the art? Again the uncertainty is too great to lead to a conclusion that same would have merely been obvious.

Even if one of ordinary skill were taught by Duffy et al. to substitute the antioxidant thereof for dibutyl cresol, St. Clair et al. does not appear to indicate that it uses dibutyl cresol, so there would be no motivation to make the substitution.

III. CONCLUSION

In light of the above amendments and remarks, it is respectfully submitted that claims 1-6 are now in condition for allowance.

If there are any additional fees associated with this Response, please charge same to our Deposit Account No. 19-3935.

Finally, if there are any formal matters remaining after this Response, the undersigned would appreciate a telephone conference with the Examiner to attend to these matters.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 3/18/13

By:

William F. Herbert
Registration No. 31,024

700 Eleventh Street, NW, Suite 500
Washington, D.C. 20001
(202) 434-1500

VERSION WITH MARKINGS TO SHOW CHANGES MADE -
37 C.F.R. §121(b) and/or (c)

A. IN THE WRITTEN DESCRIPTION

Please REPLACE the written description with the SUBSTITUTE SPECIFICATION attached hereto.

B. IN THE CLAIMS:

Please AMEND claims 1, 2 and 5 as follows: (for the Examiner's convenience, all pending claims are included below):

1. (ONCE AMENDED) A dibutyl cresol-free polyurethane foam obtained by foaming a polyurethane raw material comprising:

a polyol component;

a phenolic antioxidant selected from [3, 9-bis[2-{3-(3-t-butyl-4-hydroxy-5-methylphenyl) propioniloxy}-1,1-dimethylethyl]-2,4,8,10-tetraoxapiro [5,5] undecane and] 3,9-bis[1,1-dimehtyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane or 2,2'-thio-diethylene bis [3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate in an amount of 0.05-2.0 parts by weight for 100 parts by weight of the polyol component;

a benzotriazole UV absorbing agent in an amount of 0.1-3.0 parts by weight for 100 parts by weight of the polyol component; and

a phosphorous antioxidant in an amount of 0.5-6.0 parts by weight for 100 parts by weight of the polyol component[,

wherein the polyurethane raw material is substantially free of dibutyl cresol].

2. (ONCE AMENDED) The polyurethane foam according to claim 1, wherein the polyurethane raw material further comprises, in relation to 100 parts by weight of the polyol component, an isocyanate component (10-80 parts by weight), a catalyst (0.01-2.0 parts by weight), a foaming agent (1.0-25.0 parts by weight), and a foam stabilizer [(0.01)0.1-3.0 parts by weight).

3. (UNAMENDED) The polyurethane foam according to claim 2, wherein the polyol

component has a number average molecular weight of 2500-5000, and an OH value of 40-60.

4. (UNAMENDED) The polyurethane foam according to claim 2, wherein the isocyanate component comprises an organic polyisocyanate containing two or more isocyanate groups in one molecule and being selected from aliphatic polyisocyanate compounds, aromatic polyisocyanate compounds or modified products thereof.

5. (ONCE AMENDED) The polyurethane foam according to claim 1, wherein the phenolic antioxidant is selected to be only [3,9-bis[2-{3-(3-t-butyl-4-hydroxy-5-methylphenyl)propioniloxy}-1,1-dimethylethyl]-2,4,8,10-tetraoxaspiro {5,5} undecane] 3,9-bis[1,1-dimehtyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane.

6. (UNAMENDED) The polyurethane foam according to claim 1, wherein the benzotriazole UV absorbing agent is in the amount of 0.1-2.0 parts by weight for 100 parts by weight of the polyol component.

C. IN THE ABSTRACT

Please AMEND the Abstract as follows:

A soft polyurethane foam obtained by foaming a polyurethane raw material including a phenolic antioxidant selected from [3,9-bis[2-{3-(3-t-butyl-4-hydroxy-5-methylphenyl)propioniloxy}-1,1-dimethylethyl]-2,4,8,10-tetraoxaspiro [5,5] undecane] 3,9-bis[1,1-dimehtyl-2-[3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy]ethyl]-2,4,8,10-tetraoxaspiro[5.5]undecane and/or 2,2'-thio-diethylene bis [3-(3,5-di-t-butyl-4-hydroxyphenyl) propionate in an amount of 0.05 - 2.0 parts by weight, a benzotriazole type UV absorbing agent in an amount of 0.1 - 3.0 parts by weight, and a phosphorus type antioxidant in an amount of 0.5 - 6.0 parts by weight for 100 parts by weight of a polyol component. Color migration and discoloration of a soft polyurethane foam are prevented.